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# Book Review

*Critical Metals Handbook* by Gus Gunn, British Geological Survey/John Wiley and Sons/American Geophysical Union, 2014;
USD 139.15, ISBN: 978-0-470-67171-9 (cloth)

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This book comes in time. Demand for metals is increasing rapidly, but critical metals are of particular concern for playing a key role in high-tech applications in civil and military sectors, and strategic energy technologies. For instance, a study by The Institute for Energy and Transport of the Joint Research Centre of the European Commission concluded that five metals, namely, tellurium, indium, gallium, neodymium, and dysprosium, are at a particularly high risk of shortage, with special relevance to the wind and photovoltaic energy generation technologies. No doubt, the need for these and other critical metals will be increasing as pressure on low-$CO_2$ energy, or electronic innovation will grow, resulting in new challenges in geological, geochemical, and geophysical prospects. Current knowledge of critical metals' concentrations in the Earth's crust is far from being complete, but also technical and technological aspects of their extraction, usability, recycling, and disposal are handicapped by a substantial degree of risk and uncertainties. The book, however, touches not only different fields of the Earth's sciences, but also refers to key questions on related environmental and economic issues. In effect, readers are provided with a comprehensive source of knowledge, covering different fields of science, technology, and social life.

The book does not pretend to cover the entire range of potentially critical elements. It includes those deemed critical raw materials reported to the EU by the European Commission Working Group (2010). The first three chapters refer to more general issues, as to metal resources, use and criticality (Chapter 1 by Graedel, Gunn and Espinoza), the mining industry and the supply of critical minerals (Chapter 2 by Humphreys), and recycling prospects of critical metals and recycling limitations, (Chapter 3 by HagelÅken). The following chapters are devoted to individual metals or metal groups, described in alphabetical order. All these chapters have a similar organization, including introduction, mineralogy and physical and chemical properties, natural deposits as sources of metal extraction methods, processes and refining, specifications and uses, recycling, substitution, environmental aspects, world resources and production, future supplies, world trade, prices, outlook, acknowledgement, and references. The organization may look a bit different from case to case, depending on a particular characteristic of a given metal. Described are: antimony (by Schwarz–Schampera, Chapter 4); beryllium (by Trueman and Sabey, Chapter 5); cobalt (by Roberts and Gunn, Chapter 6); gallium (by Butcher and Brown, Chapter 7); germanium (by Melzer and Buchholtz, Chapter 8); indium (by Schwarz–Schampera, Chapter 9); lithium (by Evans, Chapter 10); magnesium (by Neelameggham and Brown, Chapter 11); platinum-group metals (by Gunn, Chapter 12); the rare earth elements (by Wall, Chapter 13); rhenium (by Millensifer, Sinclair, Jonasson and Lipmann, Chapter 14); tantalum and niobium (by Linnen, Trueman and Burt, Chapter 15); and tungsten (by Brown and Pitfield, Chapter 16). The volume includes Appendix

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1 (units and symbols used), Appendix 2 (simplified geological time scale), Appendix 3 (list of the elements in the Periodic Table sorted alphabetically by element symbol), Glossary of technical terms, and Index.

In general, this is an excellent edition, with high quality figures, readable tables, clearly written texts, well-organized structure, and precisely aimed at a broad range of non-specialists in policy, environment pollution, remediation, and economy domains; but professionals and researchers working in exploration and mining sectors, including mining finance and investment, as well as in mineral processing and manufacturing, will be greatly satisfied to have this Handbook on their bookshelves.